November 28, 2018

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Dear Ms. Dortch:

RE: Public Notice DA-18-1111A1, ET Docket 13-49
Office of engineering and Technology Requests Comment on Phase I Testing of Prototype U-NII-4 Devices

Introduction:

These comments on the Commission's report for Phase I testing of prototype U-NII-4 devices are respectfully submitted by the IEEE 1609 Dedicated Short Range Communication (DSRC) Working Group (WG)[1] in response to the Office of Engineering and Technology's request for comments in Public Notice DA 18-1111 in the ET Docket 13-49. The IEEE 1609 WG is a multidisciplinary group of industry experts who have developed the IEEE 1609 family of WAVE DSRC standards. These are industry-consensus standards created with enthusiastic support and participation from the automotive industry. The technologies addressed by our standards, as well as the companion standards from the IEEE 802.11 WG and the SAE DSRC Technical Committee, have already been deployed in thousands of devices in the United States. We applaud the Commission's completion of Phase I of the three-phase test plan described by the Commission's *U-NII-4 Public Notice* of June 1, 2016, and strongly encourage the Commission to continue with Phases II and III of the test plan before making any decisions that would impact the rules under which DSRC devices operate in the 5850-5925 MHz band (a.k.a. the 5.9 GHz band).

Need to continue testing:

Noting that any U-NII-4 device would operate under the "no harmful interference" provision of CFR47 §15.5[2]**,** we join the Wi-Fi Alliance's support for "rigorous testing for the U-NII-4 band"[3] . We also agree with the US Department of Transportation "that all three phases of research must be completed before

[1] This document solely represents the views of the IEEE 1609 Working Group and does not necessarily represent a position of either IEEE, IEEE Standards Association, IEEE 802®, or IEEE 802.11™.
[2] We emphasize that unlicensed sharing with licensed DSRC is not like sharing between two unlicensed technologies (like LTE-LAA and Wi-Fi). The bar is much higher to allow unlicensed devices to share with DSRC, which necessitates the full suite of testing. The limited nature of the Phase I tests were necessary but not sufficient to establish that protection.
[3] Reply Comments of the Wi-Fi Alliance, July 22, 2016 (page 3)

any decisions about spectrum reallocation can be made."[4] We recognize that the tests performed in Part I were necessarily, and by design, only a portion of the larger 3-phase plan. Furthermore, Phase I testing faced certain limitations with respect to physical device topology, realistic air interface propagation and fading environments, test scenarios, and prototype equipment capabilities.

We strongly urge the Commission to work with US DOT and NTIA to execute Phases II and III of the test plan, which would allow testing in the presence of real-world phenomena such as channel fading and shadowing, moving vehicles, realistic device topologies and device counts, and test scenarios. Among the topologies and scenarios we suggest be included is one in which U-NII-4 devices are operating inside a DSRC-equipped vehicle, and one in which a U-NII-4 device operates in an elevated outdoor high power (36 dBm EIRP) setting (modeling a public Wi-Fi hotspot) while nearby DSRC devices operate with powers conformant to the SAE J2945/1 standard (10-20 dBm).

We also urge the Commission to obtain updated U-NII-4 prototypes that include at least these features:

a) Wi-Fi prototypes capable of operating 160 MHz 802.11ac channels, noting that the desire to enable such a channel is consistently called out by sharing proponents as a major motivation for allowing sharing up to 5.895 GHz, and further noting that the interference characteristics of a 160 MHz channel are different from narrower channels tested in Phase I;

b) non-Wi-Fi U-NII-4 devices, for example LTE-LAA or LTE-U, since a major tenet of the Re-channelization proposal is to achieve mutual detection between DSRC and U-NII-4 in 20 MHz channels 173 and 177, and it is not clear how such mutual detection would be achieved with a non-Wi-Fi U-NII-4 device.

We assume such prototypes are easier to obtain today than they were two years ago.

We also urge the Commission to use certified and conforming DSRC devices when possible[5].

Clear signs of interference in Phase I results:

In reviewing the Phase I test results, we see clear signs of harmful interference to DSRC operation, both for DSRC operating in the upper 10 MHz channels 180, 182, and 184, which Re-channelization proponents claim would be free of harmful interference, and with DSRC operating in the lower 20 MHz channels 173 and 177. Various commenters have posited reasons why harmful interference may well be expected under Re-channelization, and the Phase I test results provide empirical proof. For example, there are several tests of Wi-Fi-to-DSRC interference where Wi-Fi is operating in 20 MHz channel 177 and DSRC is a victim of cross-channel interference when operating in 10 MHz channels 180, 182, and 184. Figure 11 provides one such result. It shows that a high power (+36 dBm EIRP) Wi-Fi signal would

[4] U.S. Department of Transportation's National Highway Traffic Safety Administration issues statement on safety value of 5.9 GHz spectrum, October 24, 2018

[5] DSRC device certification, coordinated by the OmniAir Consortium, has matured since the 2016 Public Notice. We recognize that the Re-channelization approach calls for DSRC devices to operate on 20 MHz channels 173 and 177, which are not part of the Commission's DSRC band plan or of the DSRC certification process.

interfere with DSRC reception until its signal was attenuated by more than 96 dB (from +36 dBm to -60 dBm). The interference area around such a Wi-Fi transmitter would be substantial, likely 100s of meters.

Similarly, there are several co-channel test result plots for Wi-Fi and DSRC both operating in Channel 177, and these show substantial packet loss for DSRC no matter which EDCA "mitigation mode" is configured. In order to support the full range of ITS applications planned for the 5.9 GHz band, DSRC will need to include services that have critical communication performance requirements in the lower 40 MHz, and it is clear from the test results that those services would suffer harmful and unacceptable interference (see Figure 48 for example).

The report notes that both Detect & Vacate and Re-channelization prototypes were found to be able to detect DSRC. However, in some cases the channel-move time (upper bound on interference time) averaged nearly 800 msec (see Table 22), which is so large that the resulting interference is presumptively harmful. We note that in a 2017 ETSI BRAN Technical Report[6] on RLAN sharing with 5.9 GHz ITS, it was shown that the detection time of D&V can be significantly reduced by simply including a minimum interframe space (IFS) between Wi-Fi transmissions, on the order of 300 microseconds. We suggest that in Phases II and III the Commission consider requesting modified D&V prototypes capable of inserting such a minimum IFS, to see what impact, if any, it has on detect-and-vacate times. Additional D&V characteristics that deserve careful scrutiny in Phase II testing include the detection sensitivity of DSRC signals by D&V devices and the exact process by which a D&V device can resume transmissions in the 5.9 GHz band after previously vacating.

The results of the Phase I testing, including those cited above, clearly prevent the Commission from concluding that either sharing approach is currently able to protect DSRC from harmful interference. At a minimum, more testing is needed (as noted above) to better measure the interference and consider additional mitigation steps (for example, limiting U-NII-4 devices to indoor use, or EDCA mitigation settings similar to those proposed by Wi-Fi adherents in ETSI TR 103 319).

Impact of "new developments"

In the Oct. 29, 2018 Public Notice, the Commission invites comment on how any of a set of "new developments" since 2016 should impact their evaluation of the test results, the three-phase test plan, or the pending proceeding. We comment here on the development examples listed in the Public Notice and on other important developments not listed. The conclusion is that all of the factors argue for a continuation of the three-phase test plan to Phases II and III.

One of the more important new developments, "the introduction of new technologies for autonomous vehicles", only increases the importance of effective, interference-free DSRC communication. When DSRC was first explored, the primary use cases were safety (collision avoidance), mobility efficiency, and environmental sustainability. With the rise of sensor-based automated driving, it is becoming

[6] ETSI TR 103 319 v1.1.1, August 2017, Broadband Radio Access Networks (BRAN); 5 GHz high performance RLAN; Mitigation techniques to enable sharing between RLANs and Road Tolling and Intelligent Transport Systems in the 5 725 MHz to 5 925 MHz band

increasingly clear that automated vehicles (AVs) will benefit from receiving additional sensor data over DSRC from other sources. For example, when a vehicle's forward-view sensors are blocked, a vehicle farther ahead can sense the environment and convey it to the blocked vehicle. These additional V2X data are fused with local data and assist in the AV driving function. DSRC also enables cooperative maneuver coordination among AVs. Cooperative Automated Driving has become a key new and essential use case for DSRC.

With regard to evolution of Wi-Fi standards and the development of cellular V2X standards, we do not view either of these as reducing the need for additional Phase II and III testing.

The growing momentum in DSRC deployment is another factor arguing for more testing. The largest North American automaker has begun commercial deployment, and another large automaker (already deploying DSRC in Japan) has made a public commitment to deploy DSRC in the US and Canada. Recognizing the symbiotic relationship between the market development in the US and Europe, we note that the largest automaker in Europe will begin mass deployment in 2019. Adding these commercial deployments to various other programs of federal, state, and local government, we will shortly have tens of thousands of DSRC-equipped vehicles in deployment in North America. We also see a strong commitment by a majority of the US states to deploy DSRC RSUs, with over 2000 RSUs already deployed and more than 5300 committed in the coming years. The net impact of all of these deployments will be to spur even more deployment. When this Proceeding began, DSRC was a hope. Today it is a reality. The best thing the Commission can do to accelerate the public safety benefits of DSRC is to resolve the U-NII-4 sharing Proceeding through rigorous Phase II and III testing as quickly as possible.

Finally, one development not mentioned in the Public Notice is the Commission's proposal to open 1200 MHz of new spectrum for unlicensed sharing (5925-7125 MHz). While the Commission can no doubt simultaneously consider this new proposal and the difficult prospect of sharing 45 MHz in the 5.9 GHz band, the sheer magnitude of the former cannot be ignored when assessing the public costs of imposing new DSRC rules in order to accommodate the latter.

Summary:

The IEEE 1609 WG applauds the Commission on the completion of Phase I testing and urges the Commission to continue with Phases II and III of testing before making any decision about changing the DSRC band rules. We urge the Commission to use Phase II and III testing to explore more realistic outdoor scenarios and topologies, including the case of a high power Wi-Fi hotspot next to a road or intersection. We see clear signs of cross-channel and co-channel interference in the Phase I report. We think the developments in the industry since the 2016 Public Notice only reinforce the three-phase test plan. Finally, we urge the Commission to use certified and standards-compliant DSRC devices when possible.

Respectfully submitted,

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